SYSTRON DONNER

A THORN EMI company

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MODEL VPHD15-13 S7024

INSTRUMENT DIVISION

OPERATING AND SERVICE MANUAL

The Model VPHD15-13 S7024 Power Supply is similar to the VPHD15-13MOV as described in the enclosed manual with Special Modification S7024 added.

Special Modification S7024 consist of:

1. Input volts to 208,220,230 and 235 Vac ±10% 50/60 Hz.
2. Temperature Range: 25 - 50° C.
3. See Parts Lists 065136.
4. See Schematic C065141 for circuit description.

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FSCM No. 52542

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ITEM NO.	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ACT CODE
1		065136	SHIPPING ASSY		X	X
2			SCHEMATIC	D065141	1	R
3		PD27889	TOP COVER & LABEL MTG		1	2
4		065688	TOP COVER FAB		1	2
5		065148	AC-COVER		1	2
6		840405	PLUG BUTTON		5	R
7						
9		PD2535901	CHASSIS ASS'Y #1		1	2
10		065638	CHASSIS		1	2
11		840192	RUBBER FEET		4	1
12		820371	CAPACITORS 25,000μf-25	C102 103	4	1
13			S/A C102	C105, 106		R
14		820276	5,500μf-35V	C107, 108	2	1
15		106664	FAN	B101	1	1
16		100725	BRACKET CAPACITOR		2	1
17		T900068	" " 2"		2	1
18		065612	" "		1	2
19		065614	BAFFLE		1	2
20		119112	PLATE FAN BAFFLE (RH)		1	2
21		119122	" " " (LH)		1	2
22		065639	MTG. BKT. XFMR & CHOKE		1	2
23			" " " ASS'Y	PD25358	1	R
24		T910110	GROMMET		1	R
25		T910010	"		1	R
27		PD27894	REAR PANEL ASS'Y		1	2
28		065092	REAR PANEL		1	2
29		117377	FUSE HOLDER		2	1
30		870187	FUSE 8A 250V	F1 F2	2	1
31		850150	BARRIER STRIP	TB1	1	1
32			CAPACITOR .22μf-250V	C109	1	1
33		780692	FUSE LABEL 8AMP		1	1

SHIPPING ASS'Y
VPHD 15-13 OV
S7024

065136
1 1

ITEM NO.	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO	ASSY QTY	ACT QTY	CODE
34		100827	HEX SPACERS 5/16 Lg		2	1	
35		850058	BARRIER STRIP	TB2	1	1	
36		850052	" "	TB3	1	1	
37		840217	" " LINKS		4	1	
38		100486	SOLDER LUG #6		1	R	
39		069115	AC INPUT FOILCAL		1	1	
40		069116	AC DIAL PLATE		1	2	
41		PD25360	CHASSIS ASS'y #2		1	R	
42		504317	TRANSFORMER		1	2	
43		065642	BUS BAR		3	2	
44		065643	" "		1	2	
46		PD25356	FRONT PANEL ASS'y		1	2	
47		119534	FRONT PANEL		1	2	
48		880616	SWITCH V/I	S102	1	1	
49		06516401	METER ASS'y 15 A	M102	1	2	
50		065166	METER MVMT 1ma 77Ω		1	1	
51		117397	DIAL BLANK	B065164	1	1	
52		06517002	METER ASS'y 20 V	M101	1	2	
53		065160	METER MVMT 1ma 77Ω		1	1	
54		117397	DIAL BLANK	B065170	1	1	
55		065049	P.C. BOARD		1	2	
56		102119	POT 15T-WW 2K	R401	1	1	
57		117126	RES. MF 19.1K	R402	1	1	
58		116669	SWITCH	S101	1	1	
59		085860	OUTPUT LABEL		1	1	
60		770090	LED	DS101	1	1	
61		600230	POT V. ADJ 2.5K 2W	R111	1	1	
63		PD25354	HEAT SINK ASS'y #1		1	2	
64		065641	HEATSINK		1	2	
65		065464	BRACKET, PC SUPPORT		3	2	
66		T960347	POP RIVET		6	R	

SHIPPING ASS'y
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ITEM NO	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ACT CODE
67	T990415	NYLON-PUSH IN NUT		3	R
68	T990450	P.C. SUPPORT		5	I
69	860070	#6 STAND-OFF		6	I
70	706401	TRANSISTOR, 2N3771	Q101-Q110	10	I
71	830101	TRANSISTOR SOCKETS		10	I
72	103358	MICA-WASHER		5	R
73	720132	DIODE IN1200A-1	CR104+105	2	I
74	T990350	RING, INSULATOR		2	R
75	101067	MICA-WASHER		4	R
76	116969	SOLDER, LUG		2	R
77	720010	DIODE-SCA C35F	CR109	1	I
78	T990340	RING, INSULATOR		3	R
79	T990295	MICA-WASHER		2	R
80	T960640	LUG		1	I
81	720129	DIODE - IN1199A-1	CR107&108	2	I
82	880003	SWITCH THERMAL	S103	1	I
83	860020	#4 STAND OFF		1	I
84	640020	RESISTOR .2Ω 3W	R101-R110	10	I
85	710454	DIODE IN5401	CR103, 106	2	I
86	800285	CAPACITOR .47μf-250V	C104	1	I
87	PD25355	HEAT-SINK ASS'y #2		1	R
90	PD25469	DIODE BKT ASS'y		1	2
91	120582	DIODE BKT		1	2
92	720132	DIODE IN1200A-1	CR101-102	2	I
93	800285	CAPACITOR .47μf-250V	C101	1	I
94	116869	LUG		2	R
95	101067	MICA-WASHER		4	R
96	T990350	INSUL. RING NYLON		2	R
97	T990306	FLAT-WASHER		2	R
98	T990170	LOCK-WASHER		2	R
99	T980101	HEX-NUT		2	R

SHIPPING ASS'y
VPHD 15-13 OV
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ITEM NO.	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ACT CODE
100			CHASSIS WIRING	PD25365	1	R
101			" REAR "	PD27887	1	R
104		PD2788301	AC/DC HARNESS		1	2
105		PD27883	AC/DC " LIST		1	R
107			HARNESS LAYOUT	SP542	1	R
108		PD2720201	DC HARNESS		1	2
109		PD27202	DC " LIST		1	R
110			HARNESS LAYOUT	VPHD-2	1	R
112		PD27888	JUMPER LIST		1	2
113		PD25351	COMPONENT BD-ASS'Y		1	2
214		119986	COMPONENT-BOARD		1	2
215						
216						
217						
219		025756	I.C. - μA 723C	A1 A2	2	1
221		102533	CAPACITOR 100 μf 50V	C1	1	1
222		800090	.01 μf 600V	C2	1	1
223		100134	.05 μf-50 V	C5	1	1
224		100178	.1 μf-50 V	C6	2	1
225		810060	35 μf, 25V	C7	5	1
226			S/A C6	C8		R

SHIPPING ASS'Y
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ITEM NO.	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ACT CODE
		COMPONENT BD-ASS'Y (CONT.)			
118	800055	CAPACITOR .0068µf, 600	C10	1	1
119		S/A C7	C11	-	R
120		S/A C7	C12	-	R
121		S/A C7	C13	-	R
122		S/A C7	C14	-	R
123	821023	15µf 20V	C15	2	1
124		S/A C15	C16	-	R
125	800254	.22µf 400V	C17	1	1
126	106489	.022µf 250V	C18	1	1
129	100413	DIODE IN5395	CR1	6	1
130		S/A CR1	CR2	-	R
131	720419	IN4747A	CR3	1	1
132	720440	IN4148	CR4	5	1
133	100378	IN751A	CR5	4	1
134		S/A CR4	CR6	-	R
135		" "	CR7	-	R
136	100425	IN4739A	CR8	1	1
137		S/A CR5	CR9	-	R
138	741001	2N4990	CR10	1	1
139		S/A CR1	CR11	-	R
140	100398	IN966B	CR12	1	1
141		S/A CR4	CR13	-	R
142		CR5	CR14	-	R
143		CR4	CR15	-	R
144		CR5	CR16	-	R
145		CR1	CR17	-	R
146		CR1	CR18	-	R
147		CR1	CR19	-	R

SHIPPING ASS'Y
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ITEM NO	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO	ASSY QTY	ACT CODE
149			COMPONENT BD - ASS'Y (CONT.)			
151		705071	TRANSISTOR 2N3447	Q1	2	1
152		705067	2N2905A	Q2	2	1
153			S/A Q1	Q3	-	R
154			S/A Q2	Q4	-	R
155		103856	HEATSINK		2	1
156		640506	RESISTOR 1K 2W 10%	R1	1	1
157		117188	POT 100Ω 1/2W 20	R2	7	1
158			S/A R2	R3	-	R
159		620360	1.5K 1/2W 1%	R4	2	1
160		620300	1K 1/2W 1%	R5	2	1
161		101539	470Ω 1/2W 5%	R7	5	1
162		101667	220Ω 1/2W 5%	R8	2	1
163		101498	100Ω 1/2W 5%	R9	3	1
164		101467	1KΩ 1/2W 5%	R10	3	1
165		101471	10KΩ 1/2W 5%	R11	1	1
166			S/A R10	R12	-	R
167			S/A R2	R13	-	R
168			S/A R15	R14	-	R
169		620402	1.96K 1/2W 1%	R15	2	1
170		640400	250Ω 10W	R16	2	1
171			S/A R16	R17	-	R
172		640510	1K 5W 5%	R18	1	1
173		101527	150Ω 1/2W 5%	R19	1	1
174		101459	1.5K 1/2W 5%	R20	1	1
175		600133	POT 500Ω 1/2W 28	R21	1	1
176			S/A R10	R22	-	R
177			R7	R23	-	R
178			R7	R24	-	R
179			R7	R25	-	R
180			R2	R26	-	R

SHIPPING ASS'Y
VPHD 15-13-0V
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ITEM NO	SIZE	PART NUMBER	DESCRIPTION	REFERENCE NO.	ASSY QTY	ALT	CODE
182			COMPONENT BD. ASS'Y (CONT.)				
184			RESISTOR S/A	R2 R27		R	
185			"	R4 R28		R	
186			"	R5 R29		R	
187		101454	2.2K ½w 5%	R30	2	1	
188		640528	1.8K-2w	R31	1	1	
189		101504	680K-½w 5%	R32	2	1	
190		600207	POT 2K-½w 20%	R33	1	1	
191		620436	2.26K-½w 1%	R34	1	1	
192		620593	6.65K-½w 1%	R35	1	1	
193			S/A	R9 R36		R	
194				R8 R37		R	
195				R36 R38		R	
196				R9 R39		R	
197				R7 R40		R	
198		620519	4.42K ½w 1%	R41	1	1	
199		620434	2.1K ½w 1%	R42	1	1	
200		068761	SHUNT 15A	R43	2	2	
201			S/A	R2 R44		R	
202				R2 R45		R	
203				R43 R46		R	
204				R32 R47		R	
208			WIRING REAR PANEL	PD27587	1	R	
209			T101	PD27586	1	R	
210			P.C. BOARD	PD25367	1	R	
211			FRONT PANEL	PD25362	1	R	
212			DIODE	PD25469	1	R	
213			HEATSINK OV	PD25364	1	R	

SHIPPING ASS'Y
VPHD 15-13-0V
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065136

SHEET 7 OF 7

B	ADDED F102, CHANGED S101 TO A DPST	15163

PASS TRANS STORS POS. SUPPLY

REGULATOR POS. SUPPLY

REGULATOR NEG. SUPPLY

DRIVER NEG. SUPPLY

PASS TRANSISTORS NEG. SUPPLY

O.V. CIRCUIT

TRACKING

NOTES:
1) UNLESS OTHERWISE SPECIFIED:
RESISTORS ARE IN OHMS, 1/2W, 10%
CAPACITORS ARE IN MICROFARADS
2) # SELECT AT TEST

ITEM NO.	QTY	PART NUMBER	DESCRIPTION	SCHEMATIC REF NO

LIST OF MATERIALS

PROPRIETARY DATA

DRAWN	DATE	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DECIMAL TOLERANCE	SYSTRON DONNER CORPORATION CONCORD CALIFORNIA
CHECK	DATE		
ENGR	DATE		CODE IDENT 52542
PROJECT	DATE		
MFG	DATE		
APPLICATION		NEXT ASSY	MATERIAL

SCHEMATIC

DRAWING NO. D 065141 REV B

SHEET 1 OF 1

INSTRUCTION MANUAL

This manual describes the VPH ValuPower Half Rack Series Power Supplies. It contains information of the following:

Model VPH5-60M OV
Model VPH12-35M OV
Model VPH15-31M OV

Model VPH24-22M OV
Model VPH 28-19M OV

Model VPHD15-13M OV

VPH SERIES
VALUPOWER HALF RACK POWER SUPPLIES

MODEL NO.

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SYSTRON DONNER

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SYSTRON DONNER
INSTRUMENT DIVISION
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WARRANTY POLICY

I Warranty

Systron Donner Instrument Division warrants that at the time of shipment the products manufactured by Systron Donner and sold hereunder will be free from defects in material and workmanship and will conform to the current specifications published by Systron Donner's Instrument Division.

II Warranty

A The warranty period will be one year from the date of shipment. This warranty is extended only to the original buyer.

III Warranty Adjustments

A. If any defect within this warranty appears, Purchaser shall notify Seller immediately.

B Systron Donner agrees to repair or furnish a replacement for, but not install, any product which within the standard warranty shall, upon test and examination by Systron Donner, prove defective within the above warranty period.

C No product will be accepted for return or replacement without prior approval of Systron Donner. Upon such authorization and in accordance with instructions of Systron Donner, the product will be returned to the manufacturing location, shipping charges prepaid by Purchaser.

IV Exclusions from Warranty

A The foregoing warranty is in lieu of and excludes all other expressed or implied warranties of merchantability or fitness or otherwise.

B Systron Donner will not be liable for any special or consequential damages or for loss, damages or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with any other equipment or material, or from any other cause.

C The warranty does not extend to any product manufactured by Systron Donner which has been subjected to misuse, neglect, accident, improper installation or to use in violation of instructions furnished by Systron Donner.

D The warranty does not extend to or apply to any unit which has been repaired or altered at any place other than Systron Donner; by persons not expressly approved by Systron Donner; not to any unit, the serial number of which has been removed or defaced or Changed.

E This warranty applies to new equipment only and will cover repaired or replacement items only to the extent of the balance remaining of the items original warranty period noted in Paragraph II.

F All freight charges will be paid for by the Purchaser.

June, 1985

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SECTION I
DESCRIPTION

1.1 INTRODUCTION

The ValuPower Half Rack (VPH) Series Power Supplies are flexible and dependable sources of DC power, which can be used to meet a variety of needs. These needs may range in scope from inspection and production testing, to laboratory bench testing, IC and system applications.

The voltage adjustment range makes these units well suited for specific systems applications. The ability to provide power packaged in minimum space with high reliability and performance meets the demands of most systems requirements.

This instruction manual provides general characteristics and specifications, operating procedures, theory of operation, calibration and maintenance, parts lists and related schematics for the ValuPower Half Rack series Power Supplies Models, VPH5-60M OV, VPH12-35M OV, VPH15-31M OV, VPH24-22M OV, VPH28-19M OV and VPHD15-13M OV.

1.2 DESCRIPTION

The VPH Series is a unique innovation in DC power supply technology. It provides high power output with excellent regulation, low ripple, fast response and low output impedance for powering and protecting sensitive IC's and systems.

The VPH Series units are available in five slot range outputs and one dual output model (VPHD15-13M OV) providing ±11.5 to 15.5 Vdc at 13 amps. All units are half rack, 5-1/4" high for bench or rack mounting with suitable adapters.

This series is multi-versatile for use in either multiple output power systems or in lab applications with optional meters and controls.

For multiple output power applications, the VPH Series is compatible with Trygon's RM521 and RAH-2B rack adapters. These rack confiugrations afford the user the opportunity to mix and match smaller units with different ratings providing a complete system power supply with multiple outputs for various power requirements.

1.3 GENERAL FEATURES

This series features UL Design, low noise for IC and Systems applications, extremely low output impedance, unique self-test output indicator lamp, adjustable current limiting, remote sensing and programming, overvoltage protection, no turn on/turn off transients, positive convection cooling and versatile rack and bench mounting capability for multiple output power. Output, sensing and remote programming terminals are located on the rear panel of the unit. The AC power switch, DC "ON" lamp, voltage control, and appropriate optional metering devices are all located on the front panel.

1.3.1 Constant Voltage Model

A constant voltage is maintained across the output terminals at any preset value within the rated slot voltage range, provided that the load does not draw more than either the rated output current or more than the preset limiting current value determined by the top recessed current control setting.

1.3.2 Automatic Foldback Current Limiting

Short circuit protection is provided by the automatic current limiting circuit which limits the maximum output current under all load conditions. The point at which automatic current limiting occurs is variable and may be selected anywhere between 40% of the rated output current and maximum rated output current of the unit. In the event of an overload, the current and voltage foldback into a safe operating region. In the event of a short circuit, the output current is limited to approximately 40% of the rated current.

1.3.3 Remote Programming

Remote Programming is provided in the voltage mode of operation and may be utilized over the entire voltage range of the unit. The scale factor for remote voltage programming is approximately 500 ohms per volt.

1.3.4 Adjustable Overvoltage Protection

Adjustable overvoltage protection (OV) has a special circuitry which prevents the output from exceeding a preset voltage. An external adjustment control recessed in the top cover is provided to vary the point at which the OV circuit will activate. The overvoltage crowbar will latch when an overvoltage condition occurs and must be reset by cycling the AC input power off and on again. The OV protection point should not be set lower than 1 volt above the minimum power supply voltage rating or 5.5 V minimum.

1.4 PRECAUTIONARY MEASURES

1.4.1 Wire Size

To assure proper regulation under all load conditions and to prevent severe distortions of the AC line voltage, it is very important to take into consideration the physical size and current handling capabilities of the input power line. Serious losses in regulation and an increase in ripple may result from underrated or overloaded AC input lines. The maximum AC impedance from the breaker box to the power supply should not exceed 0.5 ohms.

1.4.2 Terminal Post Resistance

All terminals and shorting links serving outputs, sensing and programming must be securely tightened before use. Serious loss of regulation and an increase in ripple can result due to a voltage drop caused by loose terminals and shorting links.

The specifications cited herein for regulation and ripple can be readily attained on every power supply providing the proper method of measurement is employed. The major consideration is that the highly stable meter and oscilloscope, specified in the calibration procedures, must be connected to the sensing terminals and not the load terminals. The reason for this precaution is that the voltage drop between the load terminals and sensing terminals will yeild an inaccurate regulation ripple measurement.

1.5 SPECIFICATIONS

Table 1-1 is a complete list of standard specifications for the ValuPower Half Rack Power Supplies.

TABLE 1-1 SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

Input:	105-132 Vac[1], 57-65 Hz. (200-250 Vac, 47-65 Hz option available)[2].
Output:	Floating; Isolated from ground, 300 Vdc maximum. Internal protection is provided for applied reverse voltage.
Regulation Line:	0.02% for 105-132 Vac line change.
Regulation Load:	0.02% or 5 mV* for no load to full load.
Ripple:	Less than 1 mV RMS; total ripple and noise less than 5 mV p-p +0.05%(to 10 MHz).
Stability:	0.05% +10 mV, for 8 hours after 30 minutes warm-up. Measured at constant line, load and ambient temperature.
Temperature Coefficient (Per°C):	0.02%/°C.
Temperature Range:	-20°C to +71°C.
Temperature Storage:	-55°C to +85°C.
Recovery Time:	50 microseconds to within 30 mV for a Δ1 change as shown in the table.
High Stability (X Option):	0.03%/8 hours. 0.1%/1000 hours. TC 0.01%/°C.
Overload Protection:	A unique patented automatic non-linear current foldback system is incorporated in these units. It is adjustable from 40% to 100% of rated load and affords maximum protection of the series pass regulator while providing maximum reliability should an overload condition occur. (A minimum short circuit current of 10% will be delivered into any class of load, ensuring proper operation with most non-linear loads).

TABLE 1-1 SPECIFICATIONS (Cont'd)

ELECTRICAL SPECIFICATIONS (Cont'd)	
AC Power Input Protection:	Rear panel mounted fuse.
Remote Programming:	Programmable over rated voltage range. Scale factor approximately 500 ohms/volt.
Remote Sensing:	Maintains rated regulation directly at the load. Maximum line drop 0.5 V per leg is included in voltage range. Internal protection is supplied for open sensing leads.
Voltage Adjustment Range:	Continuously adjustable over rated voltage range. Resolution and settability 0.1%.
UL Approval:	Designed to meet UL Recognized Component Index requirement.
GENERAL & PHYSICAL SPECIFICATIONS	
Design Principle:	Prescision Series Pass Regulation.
Operational Modes:	Constant Voltage with Automatic Current Foldback Protection.
Controls:	
Voltage:	Continuous voltage adjustment, front panel screwdriver locking adjust.
Current:	Top recessed adjustment, 40% to 100%.
Input Power:	Front panel AC ON switch (optional)[3].
Output Power:	Front panel DC output indicator.
OV Adjust:	Top recessed adjustment potentiometer.
Metering (Option)[3]:	
Voltage:	Front panel Voltmeter (meter accuracy ±2%).
Current:	Front panel ammeter (meter accuracy ±2%).
Rear Panel Power Output Terminals:	(TB-3) 1/4-20 heavy duty terminals for +V and -V.
Rear Panel Barrier Strip:	(TB-1) (1) AC; (2) Ground G; (3) AC. (TB (TB-4) (1) Negative Output -V; (2) Negative Sensing -S; (3) Remote Voltage Programming RVP: (4) Positive Sensing +S; (5) Positive Output +V.
Systems Rack Mounting Capability:	VPH units without meters can be mounted in Rack Models RPS-8B, RAH-2B or RQH-3B racks for multiple output power are used where meter option is requested. Rack Model RM521 is used for multiple output systems applications where meters and controls are required, external to the unit.

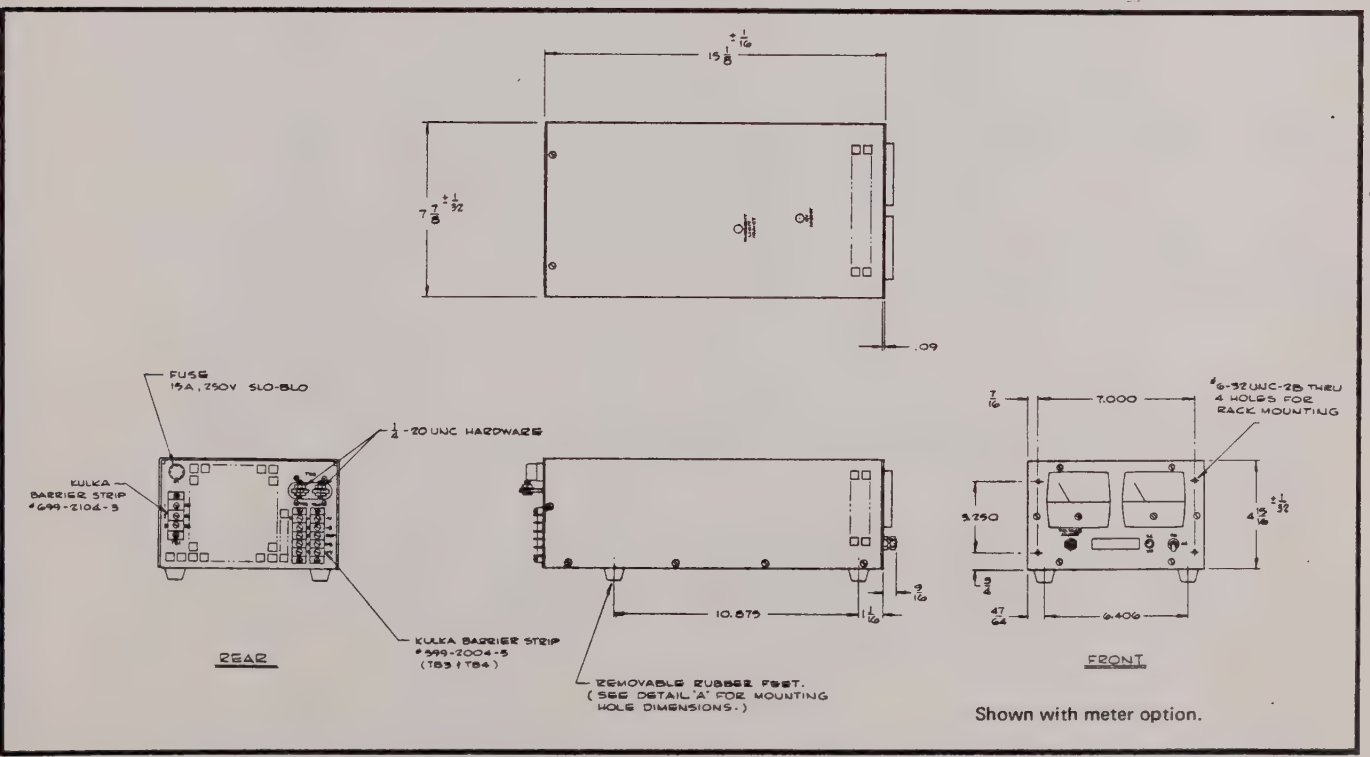
TABLE 1-1 SPECIFICATIONS (Cont'd)

GENERAL & PHYSICAL SPECIFICATIONS (Cont'd)

Overvoltage Protection:	Automatic fast acting, adjustable overvoltage protection available with recessed adjustment.
Dimensions:	5-1/4" x 7-3/4" x 16-1/4".
Weight:	40 lbs.

NOTES: [1]Derate output current 15% for operation above 125 Vac (or 238 Vac).
[2]Derate current 10% or temperature 10 C. Multiply ripply by 2x factor.
[3]When meter option (suffix M) is ordered, unit is provided with four rubber mounting feet for bench use, AC switch and DC output indicator as well as voltage and current meters.

Model	Volts	Max. Amps at Ambient of: 40°C	60°C	71°C	Nominal AC Line Current Rms Amps	Nominal Impedance DC-1 KHz Ohms	Recovery ΔI Amps	Eff* (%)
VPH 5-60 OV**	4.75 to 5.5	60	45	35	8	0.0005	15	40
VPH 12-35	11.0 to 13.0	35	24	20	9	0.001	12	50
VPH 15-31	14.0 to 16.0	31	21	18	9	0.001	10	55
VPH 24-22	23.0 to 26.0	22	15	13	10	0.001	8	57
VPH 28-19	26.0 to 30.0	19	13	11	10	0.001	6	57
VPHD 15-13 (Dual)	±11.5 to 15.5	13	9	7.5	7.5	0.001	4	51



SECTION 2

INSTALLATION AND OPERATION

2.1 MECHANICAL INSTALLATION

When the ValuPower Half Rack series power supply is to be used in a rack configuration, rack adapter RAH-2B may be used for either metered or unmetered models. The RAH-2B will accommodate two VPH units side by side. Rack model RM521 can accommodate VPH units intermixed with other modules as well.

For rack mounting, the four rubber feet are removed before placing unit into the rack adapter. The rubber feet provided on all units allow the power supply to be used as a bench supply.

2.2 ELECTRICAL CONNECTIONS

Input Power

A three-terminal barrier strip mounted on the rear panel provides AC input connections to the unit.

The power handling ability of the AC power lines feeding AC power to the unit must be considered, as serious losses in regulation and substantial increase in ripple may occur as a result of insufficient power capacity of these lines. All AC power line connections must be securely tightened and any movable electric contact surface (such as the wiper arm of a variable transformer) should be kept clear of impedance producing oxide coatings.

Care should be exercised in selecting the proper wire size for the AC input lines. The AC wire size should be sufficient so that the line drop does not exceed a value which will allow the input voltage to drop below the specified lower limit of 105 VAC.

An AWG #16 should be adequate for most short runs of 20 ft. or less. Increase wire size to #14 for up to 50 feet and to #12 for up to 100 feet.

Output, Rear Panel

On single output VPH units, main output is provided on two heavy duty terminals. A second auxilliary terminal block is provided for remote sensing and remote programming.

On dual output VPHD units, the negative output, negative remote sensing and remote programming is provided on one terminal block, with positive output, positive remote sensing, and common voltage return and common remote sensing provided on a second terminal block.

2.3 OPERATING CONFIGURATIONS

The ValuPower series power supplies are designed to operate as highly regulated constant voltage sources with automatic foldback current limiting. There are various operating configurations that can be used by proper application of shorting links

2.3 Continued

and wiring. The following paragraphs describe the various operating configurations and their connections.

Local Voltage Programming (Fig. 2-1)

To adjust the output voltage from the power supply, connect a shorting link across terminals 2 and 3. With this shorting link installed, the voltage adjust control provides adjustment of the output over the rated slot voltage range.

Remote Voltage Programming (Fig. 2-2)

Remote voltage programming is achieved by removing the shorting link from terminals 2 and 3 and substituting a resistive element of proper value across terminals 2 and 3 external to the power supply.

Sensing Connections

Local Sensing (Fig. 2-1)

Local sensing connections are made when rated regulation is not required directly at a remote load.

Connect the load to output studs +V and -V, and ascertain that shorting links are connected between terminals 1 and 2 and 4 and 5.

Remote Sensing (Fig. 2-3)

Remote sensing is used when rated regulation is required at a remote load.

Remove the shorting links between terminals 1 and 2 and 4 and 5. Using a twisted, shielded pair of wires, connect the -S (2) and +S (4) sensing terminals to the load. To prevent damage to the power supply, correct polarity of both the remote sensing and output leads must be observed. The negative remote sensing lead (-S) and negative output lead (-V) must be connected to one side of the load and the positive remote sensing lead (+S) and positive output lead (+V) connected to the other side of the load. The shield should be grounded at the power supply end of the cable.

2.4 CONTROLS

Front Panel

AC ON - switch controls power
Voltage Adjust - Potentiometer, Adjusts voltage output.

Top Cover (Recessed Controls)

Current Limit - Potentiometer adjust current limiting point
OV Adjust (option) potentiometer adjust overvoltage protection point in units having this optional feature.

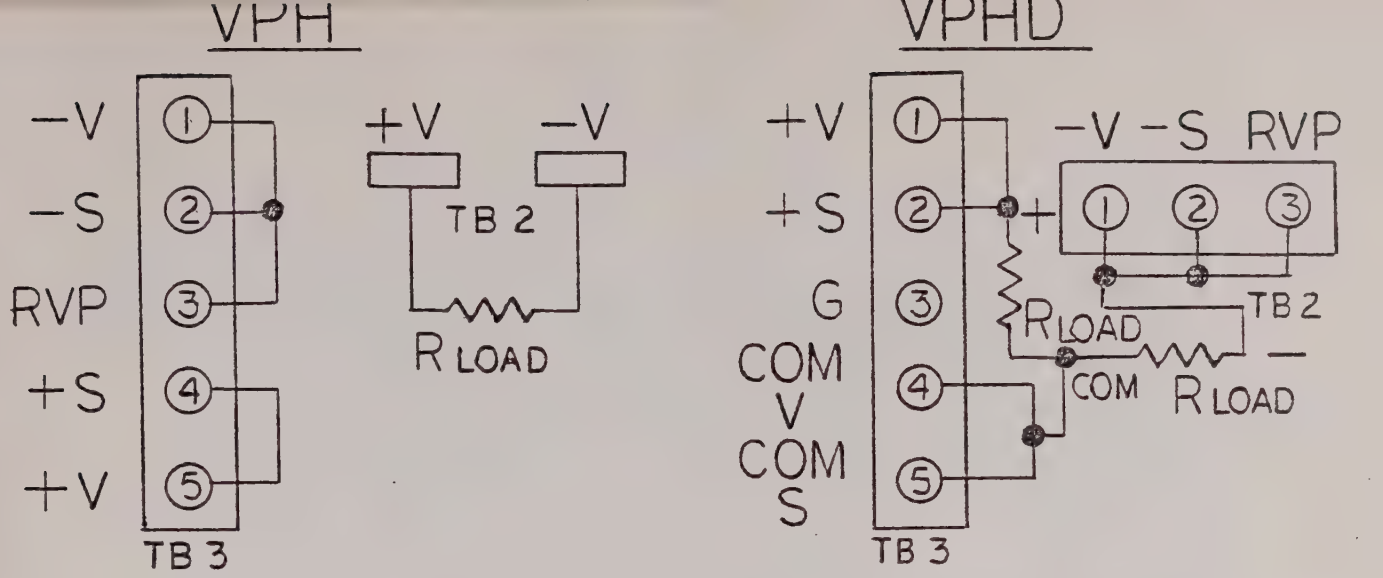


FIG 2-1 LOCAL PROGRAMMING, LOCAL SENSING

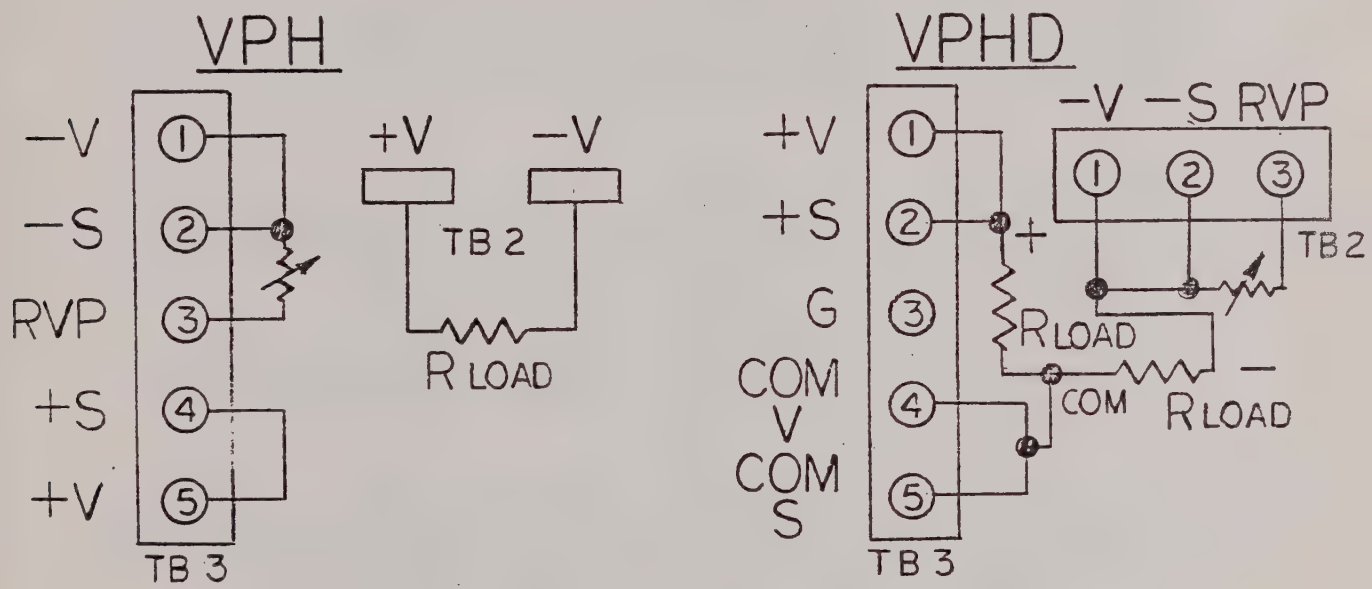


FIG 2-2 REMOTE VOLTAGE PROGRAMMING

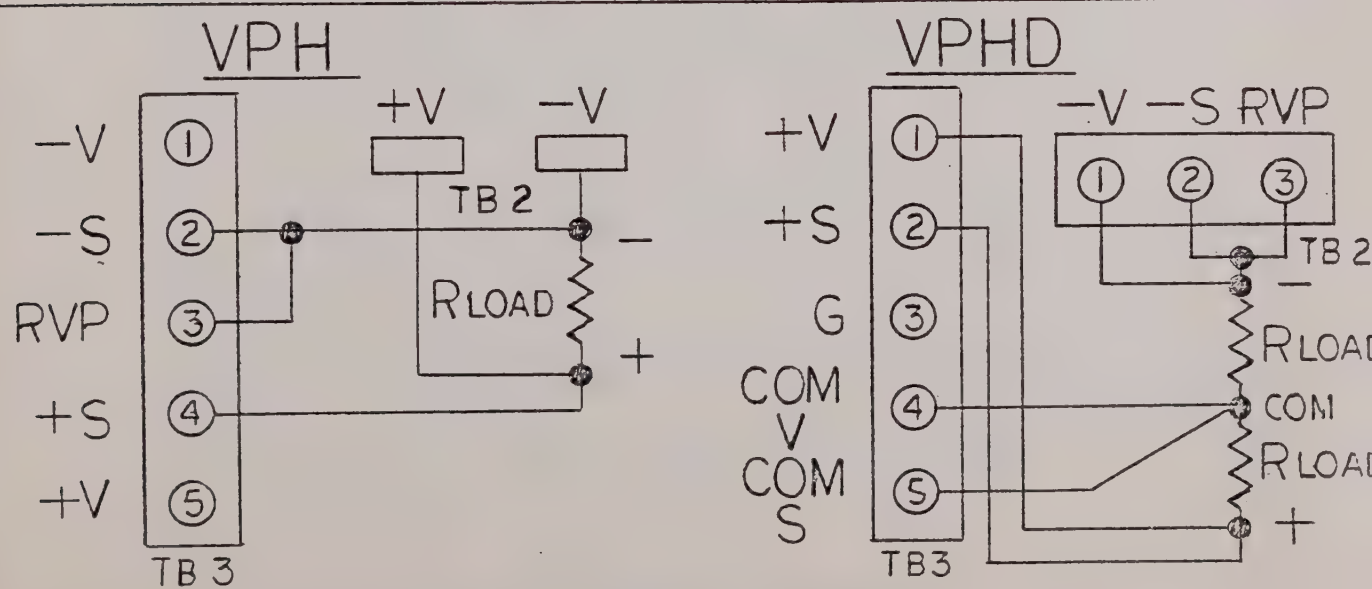


FIG 2-3 REMOTE SENSING

Internal

All internal control settings have been factory preset and require no additional adjusting. However, if it should become necessary to adjust any of the internal controls due to circuit changes caused by component aging or replacement, refer to the calibration section of this manual.

2.5 OPERATION

Control Settings

Set front panel control full CCW, top recessed controls fully CW.

Shorting Links

Prior to the application of power, connect all loads, external wiring and shorting links required for the mode of operation desired.

Grounding

Either side of the output may be grounded, or the output may be used in a floating condition.

Power On

Connect the unit to a nominal AC input power source. Set AC power switch to ON, and observe that pilot lamp is lit.

Warm-Up

No warm-up time is necessary to place the unit into operation. However, a 30 minute warm-up period is recommended to reach rated stability. The unit is now ready for operation.

SECTION 3

THEORY OF OPERATION

3.1 GENERAL

The purpose of the ValuPower series power supplies is to transform and rectify the AC input into a well regulated, stable and adjustable DC output. The following paragraphs describe the major circuits used in the power supply. As each circuit is described, reference should be made to both the Block Diagram, Figure 3-1 and the Schematic Diagram in the rear of this manual.

Primary Input

Input power is obtained through power transformer T101, diodes and filter capacitors. When power switch S101 is set to ON, the output indicator lamp DS 101 glows and AC power is applied to T101 and cooling fan B101. Regulated DC output voltage is immediately available from the power supply.

Series Regulator

The rectified voltage from the diodes and filter capacitors is directed through the Series Pass transistors. The conduction of these transistors is controlled by circuitry which causes them to act as variable resistors. Their overall resistance varies in accordance with the need of the power supply to increase or decrease its output voltage or current. The Series Pass transistors are controlled by driver stages which amplify signals from the Error Amplifier.

Reference Supply, Comparator, Error Amplifier, and Current Limiting

A single integrated circuit, A1, combined the circuitry required to perform the task usually required by many discrete components.

The stable reference voltage is generated and indicated at the circuit reference V REF. When A1 gets the zener regulated voltage across its terminals 5 and P, a precision voltage reference is developed across its terminals 4 and 5. A fixed sample of this voltage is fed into terminal 2 which is one input of the error amplifier.

The voltage which A1 compares the reference voltage to, is fed into terminal 3. Any change in the output voltage is automatically compensated for as the error amplifier generates a correction drive signal at terminal 6 which changes the output voltage accordingly.

Current limiting is provided by input 10 which will control the error amplifier's output when an overcurrent condition is present.

Terminal A is a compensating input to A1, to insure stability and prevent oscillations under certain load conditions.

Internal

All internal control settings have been factory preset and require no additional adjusting. However, if it should become necessary to adjust any of the internal controls due to circuit changes caused by component aging or replacement, refer to the calibration section of this manual.

2.5 OPERATION

Control Settings

Set front panel control full CCW, top recessed controls fully CW.

Shorting Links

Prior to the application of power, connect all loads, external wiring and shorting links required for the mode of operation desired.

Grounding

Either side of the output may be grounded, or the output may be used in a floating condition.

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Connect the unit to a nominal AC input power source. Set AC power switch to ON, and observe that pilot lamp is lit.

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No warm-up time is necessary to place the unit into operation. However, a 30 minute warm-up period is recommended to reach rated stability. The unit is now ready for operation.

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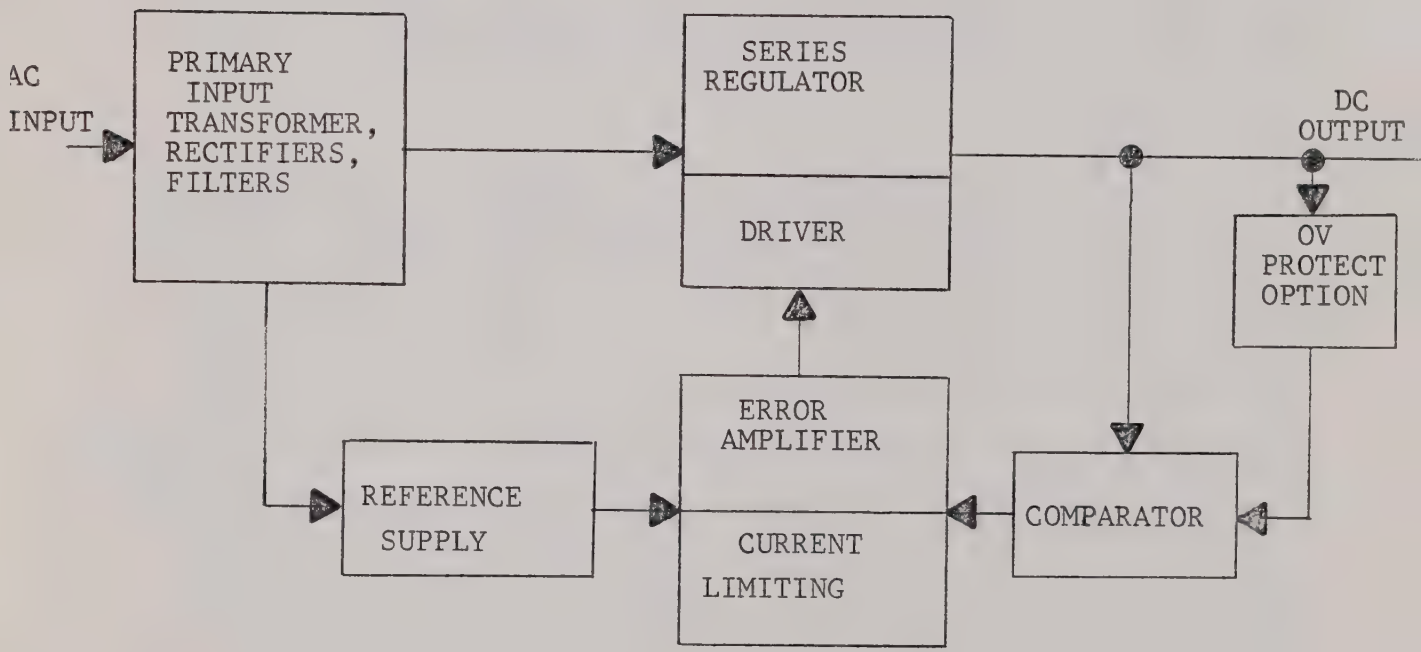
Current limiting is provided by input 10 which will control the error amplifier's output when an overcurrent condition is present.

Terminal A is a compensating input to A1, to insure stability and prevent oscillations under certain load conditions.

3.1 Continued

Overvoltage Circuit (Option)

A sample of the output voltage is developed across R21. This sample is brought to terminal 1 (anode) of the silicon unilateral switch (SUS), which has the characteristics of suddenly conducting when the applied voltage exceeds a minimum threshold. When the SUS conducts it applies a gate signal to the SCR, which crowbars the output to nominal zero.



BLOCK DIAGRAM

FIGURE 3-1

NOTE: The dual output unit uses the negative output as the Master voltage with the positive output circuitry tracking automatically.

SECTION 4

CALIBRATION AND MAINTENANCE

4.1 GENERAL

The following adjustments should be made when necessary to assure optimum operating characteristics and maximum efficiency of the ValuPower series power supplies.

4.2 TEST EQUIPMENT REQUIRED (Or Equivalent)

1. Systron Donner Digital Multimeter Type 9025
2. External Current Shunt (150A rating)
3. Variable Auto transformer, 30 ampere rating

Shorting Link Application

For test purposes shorting links should be connected across rear panel barrier strip terminals 1 and 2, 2 and 3, 4 and 5, and 6 and 7 to provide local sensing and local voltage programming operation. To reduce pickup, shielded wire must be used for all connections between test equipment and the power supply being tested. To prevent ground loops, it is important that only one ground connection be made, as shown in Fig. 4-1. Tighten all terminals as securely as possible and set the front panel control. CW.

4.3 CALIBRATION PROCEDURE

Ammeter Calibration

1. Using a standard ammeter in series with an external load, adjust the load so the unit will operate at its maximum rated current (as indicated on the standard ammeter) and voltage output.
2. Adjust ammeter adjust control (VPH R24, VPHD R45) until ammeter M101 indicates the same current as the standard meter.

Current Limit Test

1. Establish nominal output voltage
2. Set current limit control VPH R11, VPHD R3 fully CW
3. Using an external load, apply a 20% current overload to the unit under test.
4. Adjust current limit control until the overload, as indicated on ammeter MI, is limited to between 5% and 10% (1.05 to 1.10 maximum rated current).

4.3 Continued

Constant Voltage Operation

Load Regulation Test

With the equipment connected as shown in Figure 4-1, connect a suitable load resistance across the output terminal connections. The load resistance selected must be able to dissipate the rated power of the unit (P=IE) and must be of sufficient value to yield the rated output current when the rated voltage is applied. Note the voltage indicated on the Digital Voltmeter. Disconnect the resistive load from the output.

The maximum change in output DC voltage should not exceed by more than .02% or 5mv (whichever is greater) that of the output voltage indicated with the load resistance applied across the output terminals.

Line Regulation Test

Place the resistive load across the output and note the voltage indicated on the DVM. Vary the AC input power 10% above and below the nominal AC input level. The maximum change in output voltage should not exceed by more than ±0.02% or mv (whichever is greater) that of the output voltage measured at either extreme of the AC input.

Ripple Voltage Test

In order to reduce pickup, shielded test leads should be used in making ripple measurements. With the resistive load connected across the output terminals, measure the AC ripple with the AC scale of the DVM. Vary the AC input power 10% above and below the nominal AC input level. The maximum ripple amplitude should not exceed 1mv RMS.

Overvoltage Sensitivity (option) (See Page 4-5 for Dual Unit)

The trigger point of the OV protection circuit is determined by the setting of the OV control R21, located through the top cover. To set the OV circuit to trigger within the output range of the power supply, set R21 CW. Turn on the supply and adjust it for the desired OV firing point. Turn R21 CCW until the output voltage drops as indicated by the voltmeter.

To set the OV circuit to fire at higher output voltage than the output voltage of the supply, a second current limiting type power supply is needed. With the supply under test, set its output voltage to any value. Turn R21 CW and connect the second supply across its output terminals. Set the second supply's output voltage to the desired OV firing point. Turn R21 CCW until the output of the supply drops to a low value as indicated on the voltmeter. This indicates that the OV circuit has fired at the voltage set on the second power supply.

4.4 MAINTENANCE

GENERAL

This power supply is a precision electronic instrument. It is strongly recommended that only experienced troubleshooting personnel perform troubleshooting operations or attempt to repair the unit. If the power supply appears to be malfunctioning at all, the following procedure is recommended for isolating possible defects.

Loads and Interconnections

1. Disconnect all loads and interconnections.

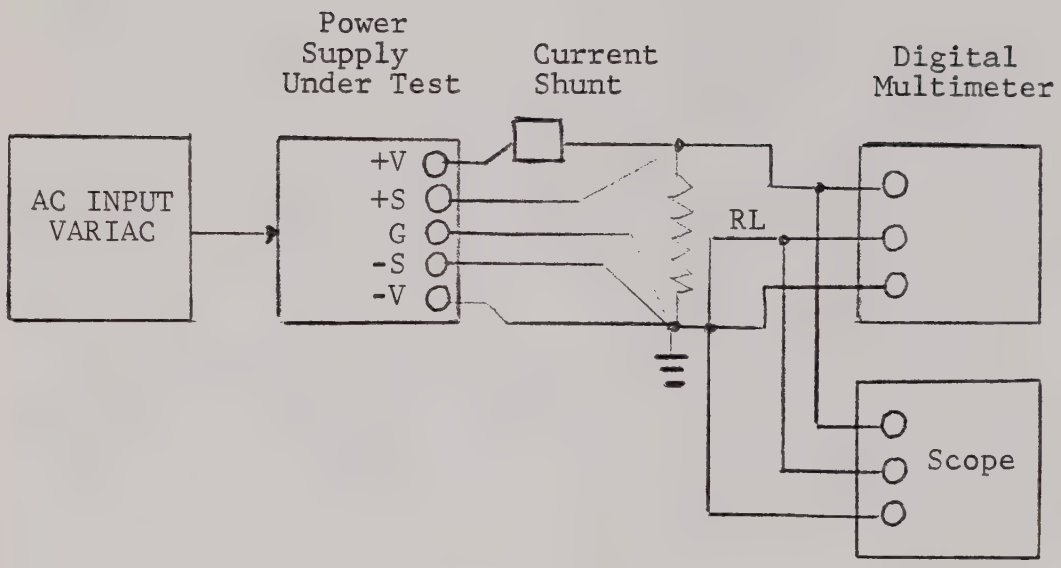
2. Connect a resistive load across the output terminals and operate the unit to determine whether the fault lies within the unit or externally. Observe that shorting links are in place across terminals to provide local sensing operation.

3. Set input voltage to nominal value (115 VAC) and operating controls for rated output. Satisfactory operation at this time would indicate that any malfunction previously encountered, is external in nature. All interconnections and loads normally used in conjunction with this power supply should then be carefully checked for electrical defects.

Troubleshooting

1. Set Voltage Adjust control fully CW. Use a high impedance digital voltmeter to check the voltages across the various circuit components, if shown on the Schematic Diagram located at the rear of this instruction manual. Any sample voltages listed apply only if the unit is operating at its nominal AC input, and has a dummy load of sufficient size connected across its output to allow operation at maximum rated current and voltage output levels. Any reading which is grossly incorrect, indicates that the stage being tested or the one immediately preceding it is defective. The Block Diagram, Schematic Diagram and appropriate sections of the Theory of Operation will prove helpful in any troubleshooting work. Proper polarity to be observed when testing can be easily obtained from the Schematic Diagram.

2. If voltage checks show no noticeable deviations from the prescribed values, disconnect AC power and proceed with point-to-point resistance checks across pots, switches, diodes, resistors, transistors, in that order.



CONSTANT VOLTAGE
OPERATION

TEST EQUIPMENT SET-UP

FIGURE 4-1

ADDENDUM FOR DUAL OUTPUT VPHD

VPHD OVERVOLTAGE PROTECTION

The overvoltage protection provided on the dual output VPHD is one whereby the total voltage of the plus and minus outputs is sensed. The overvoltage trip point is therefore approximately twice that of each individual supply. If either supply should go high in voltage it will cause the overvoltage crowbar to clamp both the plus and minus outputs to nominal zero volts.

The trigger point of the OV protection circuit is determined by the setting of the OV control R21, located through the top cover.

To set the OV circuit to trigger within the output voltage sum of the plus and minus voltages, set R21 CW. Turn on the supply and adjust the negative output voltage (the negative output is the master voltage with the positive output circuitry tracking automatically) for the desired OV firing point. Turn R21 CCW until the output voltage drops as indicated by the voltmeter.

To set the OV circuit to fire at a higher output voltage than the output voltages of the supply will adjust to, a second current limiting type power supply is needed.

Set the supply under test to its desired voltage with R21 turned CW. Connect the second supply across the plus and minus terminals of the supply under test and set its output voltage to the desired OV trip point. Turn R21 slowly CCW until the OV triggers as indicated by the drop in output voltage. This indicates that the OV circuit has fired at the voltage set on the second power supply.

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